P
ech
B

No. 83.—APRIL, 1918.

British Engineering Standards Association.

(*Incorporated 1918.*)

ORIGINALLY FORMED IN 1901 AS THE ENGINEERING STANDARDS COMMITTEE
BY
THE INSTITUTION OF CIVIL ENGINEERS.
THE INSTITUTION OF MECHANICAL ENGINEERS.
THE INSTITUTION OF NAVAL ARCHITECTS.
THE IRON AND STEEL INSTITUTE.
THE INSTITUTION OF ELECTRICAL ENGINEERS.

UNIVERSITY OF TORONTO
1920
LIBRARY

BRITISH STANDARD OF REFERENCE

FOR

AIRCRAFT DOPE AND PROTECTIVE COVERING

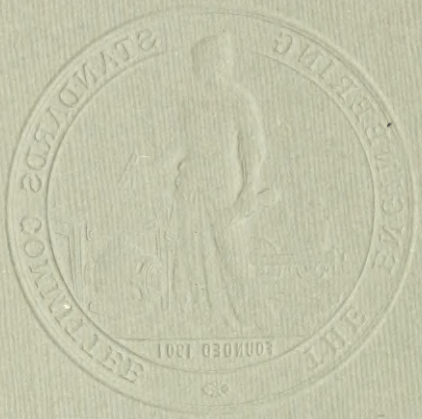
(INCLUDING SPECIFICATIONS FOR EACH INGREDIENT AND METHOD OF APPLICATION).

LONDON:
PUBLISHED FOR THE ASSOCIATION BY CROSBY LOCKWOOD & SON,
7, STATIONERS' HALL COURT, LUDGATE HILL, E.C. 4; AND 5, BROADWAY, WESTMINSTER, S.W. 1;
AND TO BE PURCHASED FROM ANY BOOKSELLER, OR DIRECT FROM THE OFFICES OF THE ASSOCIATION,
28, VICTORIA STREET, WESTMINSTER, S.W.1.

April, 1918.

COPYRIGHT. ALL RIGHTS RESERVED.

Price 1/- Net.



No. 83.—APRIL, 1918.

British Engineering Standards Association

(*Incorporated 1918.*)

ORIGINALLY FORMED IN 1901 AS THE ENGINEERING STANDARDS COMMITTEE
BY
THE INSTITUTION OF CIVIL ENGINEERS.
THE INSTITUTION OF MECHANICAL ENGINEERS.
THE INSTITUTION OF NAVAL ARCHITECTS.
THE IRON AND STEEL INSTITUTE.
THE INSTITUTION OF ELECTRICAL ENGINEERS.

BRITISH STANDARD OF REFERENCE

FOR

AIRCRAFT DOPE AND PROTECTIVE COVERING

(INCLUDING SPECIFICATIONS FOR EACH INGREDIENT AND METHOD OF APPLICATION).

LONDON:
PUBLISHED FOR THE ASSOCIATION BY CROSBY LOCKWOOD & SON,
7, STATIONERS' HALL COURT, LUDGATE HILL, E.C. 4; AND 5, BROADWAY, WESTMINSTER, S.W. 1;
AND TO BE PURCHASED FROM ANY BOOKSELLER, OR DIRECT FROM THE OFFICES OF THE ASSOCIATION,
28, VICTORIA STREET, WESTMINSTER, S.W. 1.

April, 1918.

COPYRIGHT. ALL RIGHTS RESERVED.

Price 1/- Net.

CONTENTS.

PAGE

List of Members of Main Committee 3
List of Members of Sectional Committee on Components of Aircraft and Aircraft Engines 4
List of Members of Aircraft Sub-Committee O on Dopes and Fabrics 4
Preface... 5

1. Formula for Reference Dope 7
2. Formula for "Raftite" Solvent... 7
3. Formula for Reference Protective Covering 7

INGREDIENTS FOR REFERENCE DOPE AND PROTECTIVE COVERING.

4. Cellulose Acetate 8
5. Triphenyl Phosphate 9
6. Acetone 9
7. Benzol 10
8. Alcohol 11
9. Benzyl Alcohol 11
10. Butyl Acetate 12
11. Castor Oil 12
12. Nitro-Cellulose Syrup 13
13. Carbon Black 13
14. Yellow Ochre 13

APPENDICES.

Appendix I. Distillation Apparatus 15
Appendix II. Application of Reference Dope 16
Appendix III. Application of Reference Protective Covering 16

BRITISH ENGINEERING STANDARDS ASSOCIATION.

MAIN COMMITTEE.

† SIR ARCHIBALD DENNY, BART. (*Chairman*)

SIR MAURICE FITZMAURICE, C.M.G. (*Vice-Chairman*).

SIR WILLIAM MATTHEWS, K.C.M.G. ...	Nominated by the Institution of Civil Engineers.
SIR DOUGLAS FOX	
MR. R. ELLIOTT-COOPER	
MR. ALEXANDER ROSS	
DR. W. C. UNWIN	
MR. H. A. IVATT	Nominated by the Institution of Mechanical Engineers.
MR. MICHAEL LONGRIDGE	
DR. WILLIAM H. MAW	
MR. G. AINSWORTH	Nominated by the Iron and Steel Institute.
DR. ARTHUR COOPER	
MR. ILLTYD WILLIAMS	
SIR THOMAS BELL, K.B.E.	Nominated by the Institution of Naval Architects.
SIR WILLIAM SMITH, C.B.	
SIR JOHN SNELL	Nominated by the Institution of Electrical Engineers.
COL. R. E. CROMPTON, C.B.	
MR. C. P. SPARKS	
MR. F. R. DAVENPORT	Co-opted by the nominated members to represent the Federation of British Industries.
MR. F. W. GILBERTSON	
HON. SIR CHARLES PARSONS, K.C.B. ...	Co-opted by the nominated members.
SIR ROBERT HADFIELD, BART.	
SIR RICHARD GLAZEBROOK, C.B.	

DR. J. H. T. TUDSBERY (*Hon. Secretary*).

MR. C. LE MAISTRE (*Secretary*).

MR. CHARLES DRESSER (*Assistant Secretary*).

MR. P. GOOD (*Aircraft Assistant Secretary*).

† Succeeded the late SIR JOHN WOLFE BARRY, K.C.B., February, 1918.

BRITISH ENGINEERING STANDARDS ASSOCIATION.

The following are lists of the Members of the Sectional Committee on Components of Aircraft and Aircraft Engines, and Aircraft Sub-Committee O on Dopes and Fabrics.

SECTIONAL COMMITTEE ON COMPONENTS OF AIRCRAFT AND AIRCRAFT ENGINES.

Chairman, Lt.-Col. SIR HENRY FOWLER, K.B.E. (*Assistant Director-General of Aircraft Production, Ministry of Munitions*).

Vice-Chairmen, Lt.-Col. J. G. Weir, C.M.G. (*Controller of Technical Department, Department of Aircraft Production, Ministry of Munitions*); Brig.-Gen. W. Alexander, D.S.O. (*Controller of Aeronautical Supplies, Department of Aircraft Production, Ministry of Munitions*); Lt.-Col. R. K. Bagnall-Wild, R.E. (*Director of Inspection, Aeronautical Inspection Directorate, Ministry of Munitions*).

Admiralty, Mr. E. C. Given (*Director of Airship Production*). Lt.-Col. T. R. Cave-Brown-Cave, R.A.F. (*Representing the Superintendent of Airships*).

Air Ministry (*Controller General of Equipment*) Col. The Master of Sempill (*Deputy Director Air Technical Services*).

Ministry of Munitions (*Department of Aircraft Production*) Lt.-Col. C. F. Jenkin, M.B.E., R.A.F. (Technical Department).

National Physical Laboratory, Sir Richard Glazebrook, C.B.

Aeronautical Society of Great Britain, Lt.-Col. Mervyn O'Gorman, C.B.

Society of British Aircraft Constructors Ltd., Mr. L. Coatalen; Mr. N. G. Gwynne; Mr. C. Holt Thomas; Mr. H. White-Smith.

Aircraft Steelmakers' Committee, Mr. J. H. S. Dickenson; Mr. J. Wortley Fawcett.

Technical Committee of the Motor Industries, Mr. A. A. Remington.

Brig.-Gen. Sir Capel Holden, K.C.B., R.A.

AIRCRAFT SUB-COMMITTEE O ON DOPES AND FABRICS.

Chairman, CAPT. G. W. C. KAYE, R.E. (*representing Aeronautical Inspection Directorate*).

Admiralty (Airship Department) Lt.Col. T. R. Cave-Brown-Cave, R.A.F.

Ministry of Munitions, Department of Aircraft Production, Dr. F. W. Aston; Major Stanley Clark; Lt. E. B. Falkner; Dr. T. Masterman; Lt. P. G. Pickwell; Dr. J. E. Ramsbottom; Dr. G. Rudorf; Lt. J. Smeaton.

National Physical Laboratory, Dr. G. Barr.

The Irish Power Loom Manufacturers' Association, Mr. J. Macartney; Mr. R. J. McKeown.

Society of British Aircraft Constructors Ltd., Mr. A. J. Wallace Barr; Mr. R. A. Bruce; Mr. H. Bayley; Mr. Jackson Greeves; Mr. W. H. Maxwell; Mr. O. Short; Dr. J. N. Goldsmith.

PREFACE.

The object of this Specification is to provide a Standard of Reference reproducible in any laboratory, thus enabling a satisfactory comparison to be made of various commercial dopes.

Specifications for dope for commercial application, together with detailed Specifications for ingredients, are available. (See D.100 Air Board Specification.)

This Specification in its present form was adopted by the Sectional Committee on Components of Aircraft and Aircraft Engines at their Meeting on 10th April, 1918, and approved on behalf of the Main Committee on 19th April, 1918.

G. W. C. KAYE.

Chairman of Aircraft Sub-Committee on Dopes and Fabrics.

British Engineering Standards Association.

NOTE.—*The Association desires to call attention to the fact that this Specification is intended to include the technical provisions necessary for the supply of the material herein referred to, but does not purport to include all the necessary provisions of a Contract.*

BRITISH STANDARD OF REFERENCE
FOR
AIRCRAFT DOPE AND PROTECTIVE COVERING

(INCLUDING SPECIFICATIONS FOR EACH INGREDIENT AND METHOD OF APPLICATION).

Formula for Reference Dope.

1. The British Standard Reference Dope shall be made in accordance with the following formula with ingredients which satisfy the requirements of this specification.

Cellulose Acetate	330 grams.
Triphenyl Phosphate	50 grams.
*Acetone	2,500 c.c.
*Benzol	1,200 c.c.
*Alcohol	1,200 c.c.
*Benzyl Alcohol	100 c.c.

Formula for "Raftite" Solvent.

2. The "Raftite" Solvent shall be made in accordance with the following formula with ingredients which satisfy the requirements of this specification.

*Acetone	2,500 c.c.
*Benzol	1,200 c.c.
*Alcohol	1,200 c.c.
*Benzyl Alcohol	100 c.c

Formula for Reference Protective Covering.

3. The British Standard Reference Protective Covering shall be made in accordance with the following formula with ingredients which satisfy the requirements of this Specification.

Nitro-cellulose syrup	1,160 grams.
*Butyl Acetate	750 c.c.
*Alcohol	750 c.c.
*Benzol	750 c.c.
*Acetone	1,000 c.c.
Yellow Ochre	750 grams.
Carbon Black	3 grams.
Castor Oil	260 grams.

*The quantity of these liquids shall be measured at a temperature of 15° C.

Ingredients for Reference Dope and Protective Covering

Cellulose Acetate.

4. The material shall be a product of acetylation of suitable cellulose and shall satisfy the following requirements :—

(*a*) *Description.*—The material shall be white in colour and in a fine state of division.

(*b*) *Water Content.*—The amount of moisture present shall not exceed 5·5 per cent. by weight.

(*c*) *Ash.*—The amount of ash shall not exceed 0·2 per cent. by weight.

(*d*) *Solubility.*—The solubility shall be such that 6·6 grams of the material shall be completely soluble both in 100 c.c. of acetone (Clause 6) and in 100 c.c. of "Raftite" Solvent (Clause 2) after shaking for one hour at ordinary temperatures.

(*e*) *Viscosity.*—The viscosity of solutions of 6·6 grams of the material in 100 c.c. acetone (Clause 6) and in 100 c.c. "Raftite" Solvent (Clause 2), the material being first dried at 105° C. until constant in weight, shall be as follows :—

Material.	Viscosity.	Temperature.
		°C.
Aqueous cane sugar solution containing 84 grammes cane sugar in 100 c.c. or aqueous glycerol of specific gravity 1·2243 at 25° C.	100	25
Acetone solution	85 to 95	25
Raftite solution	105 to 115	25

(*f*) *Acidity.*—The material shall be free from mineral acids and the amount of free organic acid, calculated as acetic acid, shall not exceed 0·01 per cent. by weight.

In carrying out this determination 5 grams of the material shall be shaken with 100 c.c. neutral distilled water for one hour and an aliquot part of the clear liquid titrated with a centi-normal caustic soda (N/100 NaOH) solution, using phenol phthalein as indicator.

(*g*) SO_4 *Content.*—The total SO_4 present shall not exceed 0·06 per cent. by weight.

(*h*) *Charring Point.*—The charring point of the material, either in its original state or after washing with neutral distilled

water and drying, shall not be below 205° C. when tested by the Goldsmith method.

The material shall be placed in a test tube (about 7 ins. × ½ in.) to a depth of 1 in. and heated in an oil bath (previously raised to 180° C.), at a rate of 2° C. per minute. The bath shall be kept well stirred during the operation. The temperature at which distinct colouration occurs shall be taken as the charring point.

Triphenyl Phosphate.

5. For the purposes of this specification the material shall approximate in composition to the substance known as triphenyl phosphate [$(C_6H_5)_3PO_4$] and shall satisfy the following requirements :–

(*a*) *Description.*—The material shall be a dry, well crystallized substance and shall not darken on exposure to sunlight.

(*b*) *Melting Point.*—The melting point shall lie between 45° C. and 48° C.

(*c*) *Acidity.*—The amount of free acid shall not exceed the equivalent of 0·01 gram of caustic soda (NaOH) per 100 grams of the material, using phenol phthalein as indicator.

To determine the acidity the melted material shall be shaken with neutral distilled water at a temperature between 50° and 60° C. for thirty minutes then filtered and the filtrate titrated with a centi-normal caustic soda (N/100 NaOH) solution.

(*d*) *Impurities.*—The material shall be free from chlorides, sulphates and uncombined phenol. The amount of residue left on ignition shall not exceed 0·05 per cent.

Acetone.

6. For the purposes of this specification the material shall approximate in composition to the substance known as acetone (CH_3COCH_3). It shall be prepared from calcium acetate and satisfy the following requirements :—

(*a*) *Description.*—The material shall be a clear colourless liquid.

(*b*) *Specific Gravity.*—The specific gravity shall lie between 0·796 and 0·799 at 15° C.

(*c*) *Distillation Range.*—When 100 c.c. of the material are distilled in the standard distillation apparatus (*see* Appendix I.) at 760 mm. pressure and at a rate of two drops per second 95 c.c. shall collect between 55° and 60° C.

(*d*) *Residue.*—The residual liquid from the distillation test (*c*) when heated on a water bath for one hour shall not leave more than 0·01 gram of non-volatile matter.

(*e*) *Acidity.*—The amount of free acid calculated as acetic acid estimated by titration with centi-normal caustic soda (N 100 NaOH) solution using phenol phthalein as the indicator shall not exceed 0·01 per cent. by weight.

(*f*) *Alkalinity.*—The amount of basic substances calculated as caustic soda (NaOH), estimated by titration with centi-normal (N/100) hydrochloric acid, using methyl orange as indicator shall not exceed 0·01 per cent. by weight.

(*g*) *Acetone Content.*—The acetone content determined by Messinger's iodometric method shall not be less than 98 per cent. by weight.

(*h*) *Water Content.*—Milkiness shall not appear when five parts by volume of carbon bisulphide are added gradually to one part of the material.

(*j*) *Freedom from Impurities.*—The material shall be miscible with water in all proportions without turbidity and shall comply with the following permanganate test.

One cubic centimetre of a 0·1 per cent. solution of potassium permanganate shall be added to 100 c.c. of the acetone. The colour shall not be discharged in 30 minutes when the liquid is protected from light.

Benzol.

7. For the purposes of this specification the material shall approximate in composition to the hydrocarbon known as benzene ($C_6 H_6$) and shall satisfy the following requirements :—

(*a*) *Description.*—The material shall be a clear, colourless liquid free from water and resinous substances.

(*b*) *Specific Gravity.*—The specific gravity shall lie between 0·880 and 0·890 at 15° C.

(*c*) *Distillation Range.*—When 100 c.c. of the liquid are distilled in the standard distillation apparatus (*see* Appendix I.) at 760 mm. pressure and at a rate of 2 drops per second 95 cc. shall collect between 75° and 95° C.

(*d*) *Residue.*—The residual liquid from the distillation test (*c*) when heated on a water bath for 1 hour shall not leave more than 0·01 gram of non-volatile matter.

(*e*) *Sulphuric Acid Test.*—The material shall not yield more than a faint colouration when shaken with an equal volume of pure sulphuric acid.

(*f*) *Sulphur Content.*—The sulphur content shall not be greater than 0·05 per cent. by weight.

Alcohol.

8. The material shall be of the composition and quality known as "Industrial Spirit" (containing five per cent. of wood naphtha) and shall satisfy the following requirements :—

(*a*) *Description.*—The material shall be a clear colourless liquid.

(*b*) *Specific Gravity.*—The specific gravity of the material shall not exceed 0·817 at 15° C., *i.e.*, the strength of the spirit shall not be less than 66 over proof.

(*c*) *Distillation.*—When 100 c.c. of the liquid are distilled in the standard distillation apparatus (*see* Appendix I.) at 760 mm. pressure and at a rate of two drops per second 95 c.c. shall collect between 76° and 79° C.

(*d*) *Residue.*—The residual liquid from the distillation test (*c*), when heated on a water bath for one hour, shall not leave more than 0·01 gram of non-volatile matter.

(*e*) *Purity.*—The material shall be free from paraffins, gums, resins and waxes. It shall have an agreeable odour and give a perfectly clear solution when mixed with neutral distilled water in all proportions. It shall not contain more than 0·01 per cent. by weight of free acid, calculated as acetic acid, using phenol phthalein as the indicator and shall not contain more than 0·02 per cent. of weight of basic substances, calculated as caustic soda ($NaOH$), using methyl orange as indicator.

Benzyl Alcohol.

9. The material shall approximate in composition to the substance known as benzyl alcohol ($C_6H_5CH_2OH$). It shall be prepared from Toluol (commercial Toluene), and shall satisfy the following requirements :—

(*a*) *Description.*—The material shall be a clear practically colourless liquid with only a very slight odour and shall not contain more than a trace of water.

(*b*) *Specific Gravity.*—The specific gravity shall lie between 1·048 and 1·051 at 15° C.

(*c*) *Distillation Range.*—When 100 c.c. of the liquid are distilled in the standard distillation apparatus (*see* Appendix I.) at 760 mm. pressure and at a rate of 2 drops per second, nothing shall come over below 200° C., and 95 c.c. shall collect between 200° and 205° C.

(*d*) *Residue.*—The residual liquid from the distillation test (*c*) when evaporated shall not leave more than 0·01 gram of non-volatile matter.

(*e*) *Acidity.*—When 10 c.c. of the material are shaken with 20 c.c. of neutral distilled water the aqueous layer shall remain neutral to sensitive litmus paper.

(*f*) *Chlorine Content.*—Ten cubic centimetres of the material shall be boiled with 10 c.c. of semi-normal (N/2) alcoholic potash under a reflux condenser for half-an-hour. The mixture shall be acidified with nitric acid and the chloride determined. The chlorine content, calculated as chlorine, shall not exceed 0·01 per cent. by weight.

Butyl Acetate.

10. The material shall be the product of the acetylation of commercial Butyl Alcohol and shall satisfy the following requirements :—

(*a*) *Description.*—The material shall be a clear, colourless liquid.

(*b*) *Specific Gravity.*—The specific gravity shall lie between 0·874 and 0·880 at 15° C.

(*c*) *Distillation Range.*—When 100 c.c. of the material are distilled in the standard distillation apparatus (*see* Appendix I.) at 760 mm. pressure and at a rate of two drops per second, 95 cc. shall collect between 110° and 130° C.

(*d*) *Residue.*—The residual liquid from the distillation test (*c*), when heated on a water bath for one hour shall not leave more than 0·01 gram of non-volatile matter.

(*e*) *Acidity.*—The amount of free acid calculated as acetic acid, and estimated by titration with centi-normal (N/100) caustic soda solution, using phenol phthalein as indicator, shall not exceed 0·01 per cent. by weight.

(*f*) *Water Content.*—Milkiness shall not appear when the material is mixed in any proportions with benzol (*see* Clause 7).

(*g*) *Ester Content.*—The ester content calculated as butyl acetate shall not be less than 85 per cent. by weight.

Castor Oil.

11. The material shall be genuine, refined, colourless castor oil of the quality known as "cold drawn medicinal," and shall satisfy the following requirements :—

(*a*) *Blown Oils.*—The material shall be free from "blown oils."

(*b*) *Acidity.*—The amount of free acid shall not exceed the equivalent of 0·15 gram caustic potash per 100 grams of oil.

(*c*) *Purity.*—The material shall be free from water and suspended matter.

NOTE.—Castor oil to British Pharmacopœia 1914 standard is suitable.

Nitro-Cellulose Syrup.

12. The material shall contain 20 per cent. by weight of dry nitro-cellulose, not more than 10 per cent. by weight of alcohol (*see* Clause 8), and not less than 70 per cent. by weight of butyl acetate (*see* Clause 10), and shall satisfy the following requirements :—

(*a*) *Description.*—The material shall be clear, of a pale colour and free from undissolved matter.

(*b*) *Acidity.*—The material shall be free from mineral acids and contain not more than 0·01 per cent. by weight of organic acid calculated as acetic acid.

(*c*) *Nitro-cellulose.*—The nitro-cellulose shall be a collodion cotton of good quality and shall satisfy the following requirements :—

(1) *Solubility.*—It shall be completely soluble in butyl [illegible]

(2) *Viscosity.*—The viscosity of a 5 per cent. solution of the nitro-cellulose in butyl acetate, when measured by an Ostwald viscometer, shall be between 60 and 70 at 25° C. when compared with glycerol of specific gravity 1·2 at 25° C.

(3) *Stability.*—The dry material shall comply with the Abel heat test.

Carbon Black.

13. The material shall be of the quality known as gas carbon black and shall satisfy the following requirements :—

(*a*) *Carbon Content.*—The material shall contain not less than 96 per cent. by weight of carbon.

(*b*) *Ash.*—The amount of ash shall not exceed 0·1 per cent. by weight.

(*c*) *Water Content.*—The amount of moisture present shall not exceed 3 per cent. by weight.

(*d*) *Colour.*—The colour of the material shall not differ appreciably from that of the standard deposited at the National Physical Laboratory.

(*e*) *State of Division.*—The material shall be in as fine a state of division as the standard deposited at the National Physical Laboratory.

Yellow Ochre.

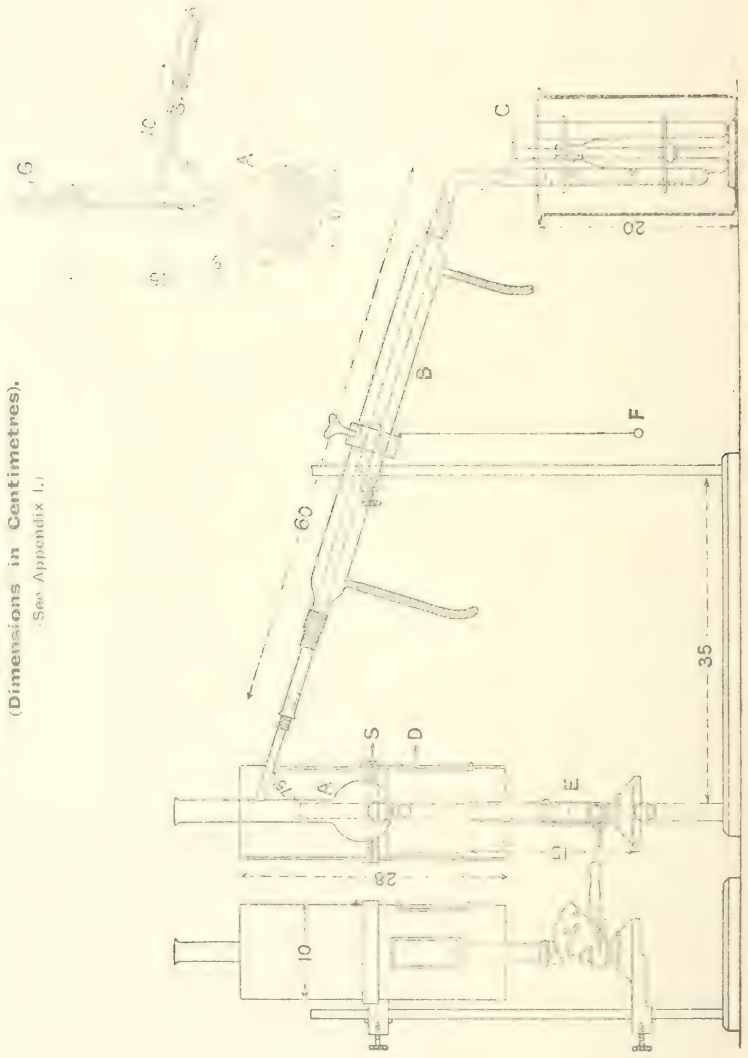
14. The material shall be a pure natural ochre consisting

BRITISH ENGINEERING STANDARDS ASSOCIATION.

STANDARD DISTILLATION APPARATUS

(Dimensions in Centimetres).

See Appendix I.)



essentially of hydrated ferric oxide.* It shall not contain any added materials and shall satisfy the following requirements :—

(*a*) *Iron Content.*—The material shall contain at least 80 per cent. of iron oxide calculated as $Fe_2 O_3$.

(*b*) *Water Content.*—The material shall not contain more than a total of 10 per cent. free and combined water.

(*c*) *Colour.*—The colour of the material shall not differ appreciably from that of the standard kept at the National Physical Laboratory.

(*d*) *State of Division.*—The material shall be triple levigated and in as fine a state of division as the standard kept at the National Physical Laboratory.

APPENDIX I.

Distillation Apparatus.

The apparatus as shown on page 14 consists of the following parts :—

(*a*) An Engler Flask "A" of the dimensions shown, fitted with a thermometer "G," with its bulb just below the exit tube of the flask.

(*b*) A receiver "C," formed of a group of graduated test tubes, held in a revolving stand surrounded by a water bath.

(*c*) A cylindrical wind screen "D," divided by a diaphragm "S" which supports the flask.

(*d*) A burner "E" with an adjustable gas tap and scale to show how far it is open.

(*e*) A pendulum "F" adjusted to give two swings per second.

The apparatus shall be used as follows :—

(*a*) One hundred cubic centimetres of the liquid to be tested shall be put into the flask and a small flame lighted.

(*b*) The flame is adjusted until the rate of distillation is two drops per second, *i.e.*, till the drops keep time with the pendulum.

(*c*) The temperature, shown by the thermometer "G," is noted when the first drop comes over into the receiver and a series of temperature readings is taken, as definite fractions are distilled, until 95 cc. have come over, when the distillation is stopped.

NOTE.—Unless the mercury thread is completely surrounded by the vapour a correction for the emergent column must be applied to the thermometer reading.

*Small quantities of this material can be obtained on application to the Superintendent of the Royal Aircraft Establishment, Farnborough.

APPENDIX II.

Application of Reference Dope.

The Dope shall be applied to the fabric as evenly as possible in such quantity as to give an increase in weight of 2 ozs. per square yard when dried for at least 24 hours at 20°—25° C.

The method recommended is to apply the dope with a bevelled varnish brush about 3 ins. wide × $\frac{5}{8}$ in. thick having stiff black bristles fixed by rivets and glue and projecting about 2 ins. Successive coats should be applied alternately in the direction of the warp and weft without "working," until a quantity of the liquid dope amounting to 22 ozs. by weight per square yard of surface has been applied. This will be in 5 or 6 coats depending on the operator. Each coat should be allowed to dry for about three-quarters of an hour at 20°–25° C. before the next coat is applied. All reasonable precautions should be taken to prevent evaporation from the dope pot between successive applications. In order to check the quantities the brush and pot should be weighed after each coat.

The brush should either be kept moist with dope solvent under a belljar or cleaned very thoroughly with solvent before being allowed to dry; in the latter case it should be allowed to soak in the dope for some time before use, as alterations in the stiffness of the bristles will affect the quantity applied very considerably. Dope should not be allowed to dry on the brush.

APPENDIX III.

Application of Reference Protective Covering.

The Protective Covering shall be applied as evenly as possible to the surface of the dope when the latter is dry and at least two days after application of the dope. It shall be applied in such quantity as to give an increase in weight of 1 oz. per square yard when dry.

This can be done very uniformly by the use of a spray which should be regulated to use 11 ozs. by weight of the liquid protective covering per square yard of doped fabric. Alternatively, it can be brushed on with a 2 inch camel-hair brush, the bristles of which project 1½ ins., in which case two coats should be applied, one in the direction of the warp and the other in the direction of the weft. A total of 11 ozs. by weight of the liquid protective covering per square yard shall be used. The second coat should not be applied until the first coat is dry.

Great care should be taken not to "work" the second coat, as otherwise it is impossible to obtain a uniform covering. Uniformity can best be judged by holding the frame up to a strong light.

British Engineering Standards Association.

PRICE LIST

OF

BRITISH STANDARD SPECIFICATIONS AND REPORTS.

JULY, 1918.

(This List cancels all previous Lists.)

NOTE.—*Directly the necessary arrangements have been completed the Publications of the Association, with a few exceptions, will also be issued in French, Italian, Spanish and Russian. Both the English Editions and the Foreign Translations will be published in octavo form, and will be available at 1/- net per copy or its equivalent in Foreign moneys.*

Report No.		Net.	Post free.
1	**Rolled Sections for Structural Purposes,** Lists of (Revised December, 1911)	2/-	2/2
2	**Tramway Rails and Fishplates,** Specification and Sections of ...	21/-	21/3
3	**Influence of Gauge Length and Section of Test Bar on the Percentage of Elongation,** Report on, by Professor W. C. Unwin, F.R.S. ...	5/-	5/2
4	**Beams,** Properties of (included in No. 6)	Withdrawn.	
5	**Locomotives for Indian Railways,** First Report on (Superseded by No. 50)	Withdrawn.	
6	**Rolled Sections for Structural Purposes,** Properties of This Publication contains Sizes, Areas, Weights, Moments of Inertia, Moments of Resistance, etc., for all Standard Sections of Structural Steel.	2/6	2/9
7	**Copper Conductors,** Tables of (Revised March, 1910)	5/-	5/3
8	**Tramway Poles,** Specification for Tubular	5/-	5/2
9	**Railway Rails,** Specification and Sections of Bull Head (Revised July, 1909)	21/-	21/3
10-1904	**Pipe Flanges,** Tables of ...	1/-	1/2
11	**Railway Rails,** Specification and Sections of Flat Bottom (Revised July, 1909)	21/-	21/4
12	**Portland Cement,** Specification for (Revised March, 1915) ...	5/-	5/3
13	**Steel for Shipbuilding,** Specification for Structural (Revised September, 1910)	5/-	5/2
14-1907	**Steel for Marine Boilers,** Specification for Structural	1/-	1/2
15-1912	**Steel for Bridges,** etc., and General Building **Construction,** Specification for Structural	1/-	1/2
16	**Telegraph Material,** Specification for	21/-	21/5
17	**Electrical Machinery,** Report on (Superseded by No. 72–1917) ...	Withdrawn.	
18	**Tensile Test Pieces,** Forms of (Revised November, 1910)	Gratis	2
19	**Temperature Experiments on Field Coils** of Electrical Machines, Report on	10/6	10/11
20	**Screw Threads,** Report on (Revised December, 1913)	2/6	2/8
21-1909	**Pipe Threads** for Iron or Steel Pipes and Tubes, Report on ...	1/-	1/2
22	**Insulating Materials,** Report on the **Effect of Temperature** on ...	Withdrawn.	
23-1905	**Trolley Groove and Wire,** Standard for ...	1/-	1/2
24	**Railway Rolling Stock,** Specifications for **Material** used in the Construction of (Revised 1911) ...	21/-	21/5
25	**Errors in Workmanship,** Report on	Withdrawn.	
26	**Locomotives for Indian Railways,** Second Report on (Superseded by No. 50).	Withdrawn.	
27	**Limit Gauges for Running Fits,** Report on Standard Systems of	5/-	5/2
28-1908	**Nuts, Bolt Heads and Spanners,** Report on	1/-	1/2
29-1909	**Steel Forgings for Marine Purposes,** Specification for Ingot ...	1/-	1/2
30-1907	**Steel Castings for Marine Purposes,** Specification for ...	1/-	1/2
31-1910	**Steel Conduits for Electrical Wiring,** Specification for ...	1/-	1/2
32-1907	**Steel Bars** for use in **Automatic Machines,** Specification for	1/-	1/2

Report No.		Net.	Post free.
33	**Carbon Filament Glow Lamps,** Specification for	5/-	5/2
34	**Screw Threads,** Tables of British Standard Whitworth, British Standard Fine and British Standard Pipe Threads (REVISED FEBRUARY, 1913)	Withdrawn.	
35	**Copper Alloy Bars** for use in **Automatic Machines,** Specification for	2/6	2/9
36	**Electrical Machinery,** Report on (Superseded by No. 72–1917)... ...	Withdrawn.	
37	**Electricity Meters,** Specification for (REVISED AUGUST, 1915)... ...	7/6	7/9
38-1913	**Limit Gauges for Screw Threads,** Report on Standard Systems for	1/-	1/2
39	**Screw Threads,** Combined Reports on (REVISED NOVEMBER, 1908) ...	Withdrawn.	
40-1908	**Cast Iron Low Pressure Heating Pipes,** Specification for Spigot and Socket	1/-	1/2
41	**Cast Iron Flue or Smoke Pipes,** Specification for Spigot and Socket...	2/6	2/8
42	**Steam Engines for Electrical Purposes,** Report on Reciprocating	5/-	5/2
43	**Boiler Tubes,** Specification for Charcoal **Iron** Lap-welded...	2/6	2/8
44-1909	**Cast Iron Pipes for Hydraulic Power,** Specification for ...	1/-	1/2
45-1917	**Sparking Plugs** (for Internal Combustion Engines), Report on Dimensions for	1/-	1/2
46-1909	**Keys and Keyways,** Specification for	1/-	1/2
47	**Steel Fishplates** for Bull Head and Flat Bottom Railway Rails, Specification and Sections of (REVISED DECEMBER, 1914)	10/6	10/9
48-1909	**Wrought Iron** of Smithing Quality for Shipbuilding (Grade D), Specification for	1/-	1/2
49	**Ammeters and Voltmeters,** Specification for	5/-	5/2
50	**Locomotives for Indian Railways,** Third Report on (Superseding Nos. 5 and 26)	21/-	21/5
51	**Wrought Iron** for use in Railway Rolling Stock ("Best-Yorkshire" and Grades A, B and C), Specification for (REVISED AUGUST, 1913)	10/6	10/9
52	**Lampholders and Caps,** Specification for Bayonet Socket	Under Revision.	
53-1913	**Boiler Tubes** for Locomotive Boilers, Specification for Cold Drawn Weldless **Steel**...	1/-	1/2
54	**Screw Threads, Nuts and Bolt Heads** for use in **Automobile** Construction, Report on	2/6	2/8
55	**Copper and Bronze Wire,** Report on Hard Drawn	10/6	10/9
56	**Yield Point** and **Elastic Limit,** Definitions of	Gratis.	-/2
57	**Small Screws,** Report on Heads for...	2/6	2/8
58	**Cast Iron Soil Pipes,** Specification for Spigot and Socket	5/-	5/3
59	**Cast Iron Waste and Ventilating Pipes** (for other than Soil Purposes), Specification for Spigot and Socket	5/-	5/3
60	**Tungsten Filament Glow Lamps** (Parts 1 and 2), Report on Experiments on	21/-	21/6
61	**Copper Tubes** and their **Screw Threads** (primarily for domestic and similar work), Specification for ...	2/6	2/9
62	**Marine Boiler Stays, Screwing** for	Gratis.	-/2
63-1913	**Broken Stone and Chippings,** Specification for Sizes of ...	1/-	1/2
64	**Fishbolts and Nuts** for Railway Rails, Specification for	5/-	5/2
65-1914	**Salt-Glazed Ware Pipes,** Specification for...	1/-	1/2
66	**Copper-Alloy Three-Piece Unions** (for Low and Medium Pressure Screwed Copper Tubes), Specification for	5/-	5/3
67	**Ceiling Roses,** Specification for Two- and Three-Plate	5/-	5/2
68	**Steel Conductor Rails,** Method of Specifying the **Resistance** of ...	10/6	10/8
69	**Tungsten Filament Glow Lamps** (Vacuum Type) for **Automobiles,** Report on...	2/6	2/8
70	**Pneumatic Tyre Rims** for Automobiles, Motor Cycles and Cycles, Report on...	5/-	5/3
71-1917	**Wheel Rims and Tyre Bands for Solid Rubber Tyres** for **Automobiles,** Report on Dimensions of	1/-	1/2
72-1917	**Electrical Machinery,** British Standardisation Rules for ...	1/-	1/2
73	**Wall Plugs and Sockets,** Specification for	5/-	5/2
74-1917	**Charging Plug and Socket,** for Vehicles Propelled by Electric Secondary Batteries, Specification for	1/-	1/2
75-1916	**Steels for Automobiles,** Specification for **Wrought**	1/-	1/2
76-1916	**Tars, Pitches, Bitumens** and **Asphalts** when used for Road Purposes, Report on **Nomenclature** of and Specifications for **Tar** and **Pitch** for Road Purposes	1/-	1/2
77	**Electrical Pressures** for **New Systems** and **Installations** (Low and Medium Pressures)	Gratis	-2
78-1917	**Cast Iron Pipes** and Special Castings for **Water, Gas** and **Sewage,** Specification for	1/-	1/3
80-1917	**Magnetos for Automobile and Aircraft Purposes,** Report on Dimensions of	1/-	1/2
83-April, 1918,	**Dope** and **Protective Covering** for **Aircraft,** Standard of Reference for	1/-	1/2
84-June, 1918.	**B.S.F. (British Standard Fine) Screw Threads,** and their **Tolerances,** Report on ...	1/-	1/2
85-April, 1918,	**Steel** for **Aircraft,** for **Government Purchases** in the **United States of America,** Specifications for	1/-	1/2

INTERIM REPORTS

C.L. 2582	**Ball Journal Bearings,** Interim Report on Sizes of Single Row	Gratis	-/2
C.L. 3750	**French Metric Screw Threads** for **Aircraft** Purposes ...	-/6	-/8